

MAGNETORESISTIVE FLUX FOCUSING EDDY CURRENT FLAW DETECTION5 Abstract of the Disclosure

A giant magnetoresistive flux focusing eddy current device effectively detects deep flaws in thick multilayer conductive materials. The probe uses an excitation coil to induce eddy currents in conducting material perpendicularly oriented to the coil's longitudinal axis. A giant magnetoresistive (GMR) sensor, surrounded by the excitation coil, is used to detect generated fields. Between the excitation coil and GMR sensor is a highly permeable flux focusing lens which magnetically separates the GMR sensor and excitation coil and produces high flux density at the outer edge of the GMR sensor. The use of feedback inside the flux focusing lens enables complete cancellation of the leakage fields at the GMR sensor location and biasing of the GMR sensor to a location of high magnetic field sensitivity. In an alternate embodiment, a permanent magnet is positioned adjacent to the GMR sensor to accomplish the biasing. Experimental results have demonstrated identification of flaws up to 1 cm deep in aluminum alloy structures. To detect deep flaws about circular fasteners or inhomogeneities in thick multilayer conductive materials, the device is mounted in a hand-held rotating probe assembly that is connected to a computer for system control, data acquisition, processing and storage.